

WHAT IS CLAIMED IS:

1. An antenna assembly suitable for use in a level measurement device for measuring the level of a material in a container, the antenna assembly comprising:

- (a) a rod antenna having a lower end and an upper end;
- (b) a coupling sleeve defining a tubular passage and including a coupling mechanism for coupling with the container, the coupling sleeve being coupled to the upper end of said rod antenna such that the upper end of said rod antenna closes one end of the tubular passage; and
- (c) a transition structure extending longitudinally into the tubular passage, the transition structure including
 - (i) a waveguide for directing electromagnetic energy into said rod antenna, the waveguide having a top end short-circuited by a rear wall,
 - (ii) a dielectric material filling the interior of said waveguide, said dielectric material having a bottom end located proximate the upper end of said rod antenna and a top end abutting the rear wall, and
 - (iii) an excitation element projecting through said waveguide into said dielectric material for converting electrical energy into electromagnetic wave energy.

2. The antenna assembly claimed in claim 1, wherein said dielectric material has a longitudinal axis and wherein said dielectric material has a coaxial bore extending longitudinally from the top end into said dielectric material and terminating in a distal end.

3. The antenna assembly claimed in claim 2, wherein the coaxial bore is circular in cross-section and includes a tapered conical tip at its distal end.

4. The antenna assembly claimed in claim 2, wherein said excitation element includes a coaxial cable projecting radially through said waveguide and into said dielectric material, and a metal disk connected to the centre conductor of said coaxial cable, said metal disk being located proximate the coaxial bore.
5. The antenna assembly claimed in claim 4, wherein said dielectric material has a radially extending bore in communication with the coaxial bore for accommodating said excitation element.
6. The antenna assembly claimed in claim 5, wherein said transition structure further includes a cap-shaped enclosure press-fit upon the top end of said waveguide, said cap-shaped enclosure providing the rear wall, and wherein said coaxial cable passes through an orifice in said cap-shaped enclosure, said transition structure further including a cable mount for securing said coaxial cable to said cap-shaped enclosure.
7. The antenna assembly claimed in claim 2, wherein said coaxial bore includes a first circular bore proximate the top end in communication with a second circular bore distant from the top end, said first circular bore having a first diameter and said second circular bore having a second diameter, said second diameter being less than said first diameter.
8. The antenna assembly claimed in claim 7, wherein said second circular bore includes a tapered conical tip at its distal end.
9. The antenna assembly claimed in claim 1, wherein said transition structure further includes a cap-shaped enclosure press-fit upon the top end of said waveguide, said cap-shaped enclosure providing the rear wall.

10. The antenna assembly claimed in claim 9, wherein said cap-shaped enclosure is coupled to said coupling sleeve through a spring ring.
11. The antenna assembly claimed in claim 9, further including an o-ring sealing said coupling sleeve and said cap-shaped enclosure.
12. The antenna assembly claimed in claim 9, wherein said transition structure has a longitudinal axis and is rotatable about its longitudinal axis relative to said coupling sleeve.
13. The antenna assembly claimed in claim 1, wherein said dielectric material has a first diameter and the upper end of said rod antenna has a second diameter, and wherein said antenna assembly further includes a metal ring having a diameter larger than the first diameter and smaller than the second diameter, the metal ring being located coaxial with the bottom end of said dielectric material.
14. The antenna assembly claimed in claim 13, wherein said metal ring is a thin tubular metallic element.
15. The antenna assembly claimed in claim 13, further including a guide tube coaxial with the bottom end of the dielectric material for holding the metal ring in position.
16. A level measurement system for measuring the level of a material in a container, comprising:
a controller having a receiver component and a transmitter component; and
a transducer for emitting electromagnetic energy and coupling reflected electromagnetic energy, said transducer having an input port operatively coupled to the transmitter component and being responsive to the transmitter component for emitting the electromagnetic energy, and having an output port operatively coupled

to the receiver component for outputting reflected electromagnetic energy coupled by said transducer, the receiver component converting the reflected electromagnetic energy into corresponding electrical signals, said controller including a program component for determining the distance travelled by the electromagnetic energy,

said transducer including an antenna assembly, including,

- (a) a rod antenna having a lower end and an upper end;
- (b) a coupling sleeve defining a tubular passage and including a coupling mechanism for coupling with the container, said coupling sleeve being coupled to the upper end of said rod antenna such that the upper end of said rod antenna closes one end of the tubular passage; and
- (c) a transition structure extending into the tubular passage, said transition structure including
 - (i) a waveguide for directing electromagnetic energy into said rod antenna, the waveguide having a top end short-circuited by a rear wall,
 - (ii) a dielectric material filling the interior of said waveguide, said dielectric material having a bottom end located proximate the upper end of said rod antenna and a top end abutting the rear wall, and
 - (iii) an excitation element projecting through said waveguide into said dielectric material for converting electrical energy into electromagnetic wave energy.

17. The antenna assembly claimed in claim 16, wherein said dielectric material has a longitudinal axis and wherein said dielectric material has a coaxial bore extending longitudinally from the top end into said dielectric material and terminating in a distal end.

18. The antenna assembly claimed in claim 17, wherein the coaxial bore is circular in cross-section and includes a tapered conical tip at its distal end.

19. The antenna assembly claimed in claim 17, wherein said excitation element includes a coaxial cable projecting radially through said waveguide and into said dielectric material, and a metal disk connected to the centre conductor of said coaxial cable, said metal disk being located proximate the coaxial bore.

20. The antenna assembly claimed in claim 19, wherein said dielectric material has a radially extending bore in communication with the coaxial bore for accommodating said excitation element.

21. The antenna assembly claimed in claim 20, wherein said transition structure further includes a cap-shaped enclosure press-fit upon the top end of said waveguide, said cap-shaped enclosure providing the rear wall, and wherein said coaxial cable passes through an orifice in said cap-shaped enclosure, said transition structure further including a cable mount for securing said coaxial cable to said cap-shaped enclosure.

22. The antenna assembly claimed in claim 17, wherein said coaxial bore includes a first circular bore proximate the top end in communication with a second circular bore distant from the top end, said first circular bore having a first diameter and said second circular bore having a second diameter, said second diameter being less than said first diameter.

23. The antenna assembly claimed in claim 22, wherein said second circular bore includes a tapered conical tip at its distal end.

24. The antenna assembly claimed in claim 16, wherein said transition structure further includes a cap-shaped enclosure press-fit upon the top end of said waveguide, said cap-shaped enclosure providing the rear wall.

25. The antenna assembly claimed in claim 24, wherein said cap-shaped enclosure is coupled to said coupling sleeve through a spring ring.

26. The antenna assembly claimed in claim 24, further including an o-ring sealing said coupling sleeve and said cap-shaped enclosure.

27. The antenna assembly claimed in claim 24, wherein said transition structure has a longitudinal axis and is rotatable about its longitudinal axis relative to said coupling sleeve.

28. The antenna assembly claimed in claim 16, wherein said dielectric material has a first diameter and the upper end of said rod antenna has a second diameter, and wherein said antenna assembly further includes a metal ring having a diameter larger than the first diameter and smaller than the second diameter, the metal ring being located coaxial with the bottom end of said dielectric material.

29. The antenna assembly claimed in claim 28, wherein said metal ring is a thin tubular metallic element.

30. The antenna assembly claimed in claim 28, further including a guide tube coaxial with the bottom end of the dielectric material for holding the metal ring in position.